

USING ABERRANT BEHAVIORS AS REINFORCERS FOR AUTISTIC CHILDREN

MARJORIE H. CHARLOP

CLAREMONT MCKENNA COLLEGE

PATRICIA F. KURTZ

CLAREMONT GRADUATE SCHOOL

AND

FRAN GREENBERG CASEY

THE GEORGE WASHINGTON UNIVERSITY

In a series of experiments, we assessed the efficacy of using autistic children's aberrant behaviors as reinforcers to increase their correct task responding. In Experiment 1, reinforcer conditions of stereotypy, food, and varied (food or stereotypy) were compared. In Experiment 2, the conditions were delayed echolalia, food, and varied (food or delayed echolalia), and in Experiment 3, perseverative behavior was compared with stereotypy and food as potential reinforcers. A multielement design was used for all comparisons, and side-effect measures were recorded during and after teaching sessions as well as at home. Results indicated that, in general, task performance was highest when brief opportunities to engage in aberrant behaviors were provided as reinforcers. Edibles were associated with the lowest performance. Furthermore, no negative side effects (e.g., an increase in aberrant behaviors) occurred. The results are discussed in terms of suggesting a more pragmatic treatment approach by addressing the contingent use of autistic children's aberrant behaviors as reinforcers.

DESCRIPTORS: autism, aberrant behaviors, stereotypy, delayed echolalia, perseverative behavior

Identifying reinforcers for autistic children has been problematic in that these children often do not respond to stimuli that interest other children (e.g., toys) or to social reinforcers (e.g., praise, smiles, or approval). Although primary (food) reinforcers can be effective (e.g., Egel, 1981), various problems have been associated with their use, including rapid satiation and difficulties in administration.

Premack (1959) demonstrated that a highly preferred (i.e., high-frequency) activity can be used to

reinforce a less preferred (i.e., low-frequency) response. Applying this principle with autistic children, their most preferred or frequent activities are often aberrant behaviors such as stereotypy (Lovaas, Koegel, Simmons, & Long, 1972). Accordingly, stereotypy, albeit inappropriate behavior, may effectively function as a reinforcer. Indeed, results from several studies have provided initial support for this notion (Hung, 1978; Sugai & White, 1986; Wolery, Kirk, & Gast, 1985). Importantly, Wolery et al. (1985) reported no negative side effects in that no increases in overall frequency of stereotypy occurred as a result of providing brief, controlled periods of stereotypy contingent upon correct response. Although these studies are quite promising, additional research is needed, because only a few children have participated in previous studies and a direct comparison of edibles and stereotypy as reinforcers has not been conducted.

The possibility that other high-frequency behaviors displayed by autistic children may also have

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Reprints may be obtained from Marjorie H. Charlop, Psychology Department, Claremont McKenna College, Claremont, California 91711.

reinforcing properties merits investigation. For example, many verbal autistic children exhibit delayed echolalia, the repetition of previously heard utterances (Fay & Schuler, 1980; Ricks & Wing, 1975). These children often repeat specific words or phrases, leading some researchers to suggest that particular forms of delayed echolalia may possess reinforcing functions (e.g., Lovaas, Varni, Koegel, & Lorsch, 1977; Prizant & Rydell, 1984). Similarly, autistic children's perseverations with specific objects is another high-frequency behavior that may have reinforcing properties (Epstein, Taubman, & Lovaas, 1985; Lovaas, Newsom, & Hickman, 1987). The children's repeated display of delayed echolalia and perseverative behavior contrasts sharply with their general unresponsiveness to their environment. Thus, it seems likely that these behaviors may also serve as reinforcers.

During the past 5 years, we conducted a series of three experiments evaluating the efficacy of using aberrant behaviors (stereotypy, delayed echolalia, and perseverative behavior) as potential reinforcers for autistic children. In Experiment 1, we extended previous research on using stereotypy as a potential reinforcer by directly comparing its use as a reinforcer with both food and conditions of varied consequences (food or stereotypy) in a multielement format. We included the varied consequence condition because Egel (1981) suggested that presentation of two or more reinforcers in a varied format may maximize reinforcer effectiveness. In Experiment 2, we compared the use of delayed echolalia as a potential reinforcer with both food and varied consequences (delayed echolalia or food). Finally, in Experiment 3, we compared the use of perseverative behavior as a potential reinforcer with stereotypy and food. In all three experiments, assessments of potential negative side effects (i.e., an increase in the overall frequency of the aberrant behaviors) were conducted in a more comprehensive manner than in previous investigations.

GENERAL METHOD

Subjects

All participants had been diagnosed as autistic by two independent agencies according to DSM-

III criteria (American Psychiatric Association, 1980). All children had attended biweekly therapy sessions at an after-school behavior modification program for autistic children for a minimum of 6 months. Children were selected to participate in the experiments based on classroom teachers', parents', and therapists' reports that they appeared unmotivated to learn and often engaged in aberrant and off-task behaviors.

Setting and Tasks

Experimental sessions were conducted in a work room at the children's after-school program. In this room were two child-size chairs, a table, a large storage cabinet, and various toys and educational stimuli. The work room was connected to a large observation room by a one-way mirror, which was used by reliability observers during experimental sessions.

Three tasks (e.g., naming body parts, use of prepositions, and pronouns) were selected from each child's academic curriculum for presentation during experimental sessions. Each task had been part of the child's regular therapy sessions for several months but had proven quite difficult to learn.

Design

A multielement design was used to assess the differential effectiveness of three potential reinforcers: (a) food, (b) aberrant behavior (either stereotypy, delayed echolalia, or perseverative behavior, depending on the experiment), and (c) varied consequences (food or aberrant behavior). For Experiment 3, however, the consequence conditions consisted of stereotypy, food, and perseverative behavior, and a varied consequence condition was not presented. No experimental condition was presented more than three times consecutively, and the total number of sessions of each condition was varied to assess any changes in performance over time.

General Procedure

Baseline. Each child was presented with a typical 15-min work session during which the selected tasks were presented as described below in the food-as-consequence condition. For Experiments 1 and

2, baseline consisted of one or two probes per week collected over a 6- to 8-month period before the multielement analyses began. Baseline for Experiment 3 was presented during the weeks immediately preceding the multielement analysis.

Experimental conditions. Two 15-min experimental sessions were presented weekly to each child, usually 2 to 5 days apart. Sessions were designed to simulate as closely as possible typical work sessions in the after-school program. The experimenter sat facing the child and presented trials when the child was sitting attentively and providing eye contact. The order of presentation of tasks within a session was randomly varied across sessions. Throughout all conditions, after each correct response, the experimenter immediately provided both praise (e.g., "That's right! Good boy.") and a consequence corresponding to the particular reinforcer condition for that session. After an incorrect response or failure to respond within 5 s, a verbal "No" was presented. After two consecutive incorrect trials, the experimenter provided a correction trial (e.g., requested "Give me blue block" and pointed to the block), verbal praise, and a reinforcer contingent upon correct response. Correction trials were not included in the data analysis. Following each trial, the experimenter recorded the child's response (correct or incorrect) on a data sheet. During and after each session, the occurrences of the aberrant behavior, stereotypy, and off-task behavior were recorded for each child.

Consequence Conditions

The specific consequences used in the following conditions were determined to be desirable for each child based on direct observations and parent and therapist reports.

Food as a consequence. During this condition, a preferred food (e.g., small piece of chocolate, cereal, or cookie) from a variety tray was presented contingent upon each correct response. Typically, the child was asked to choose from the available treats.

Aberrant behavior as a consequence. In this condition, the child was allowed, and sometimes prompted, to engage in specific aberrant behavior for 3 to 5 s contingent upon correct response. In

Experiment 1, the aberrant behavior consisted of a specific type of stereotypy; in Experiment 2, the aberrant behavior was delayed echolalia; and in Experiment 3, two conditions of aberrant behaviors, perseverative behavior and stereotypy, were evaluated. For example, in Experiment 1, Child 1 was allowed to posture his hand in front of his eyes for a few seconds after each correct answer. On the first few trials, however, it was necessary for the experimenter to encourage the child verbally to engage in stereotypy (e.g., "You can look at your fingers now.").

Varied consequences. During this condition, contingent upon correct response, the child was permitted to choose either a food treat or the opportunity to engage in 3 to 5 s of a specific aberrant behavior. No more than three consequences of one kind were presented consecutively; if the child continually requested a stereotypic behavior, the experimenter said, "Let's eat something now, and you can _____ later."

Experimental session observation. During each session, a primary observer in the observation room recorded each occurrence of the aberrant behavior (when not used as a consequence), stereotypy, and off-task behaviors using a 10-s partial interval scoring procedure. Prior to the study, observers were trained in the use of this procedure by jointly observing, identifying, and recording the child's defined behaviors with the experimenter until at least 90% interobserver agreement was demonstrated. A prerecorded tape signaling the intervals was played throughout the session, and the observers marked occurrences on precoded data sheets. Operational definitions for each child's observed behaviors were determined prior to the study based on parent and therapist report and by observations of each child during free-play and regular therapy sessions (see Tables 1, 2, and 3, for Experiments 1, 2, and 3, respectively).

Postexperimental session observation. Following each 15-min experimental session, a 15-min postsession observation was conducted in which behaviors were observed and recorded in the same manner. Two postsession observation settings were used for Experiments 1 and 2: (a) a work session, in which the child worked with another therapist

Table 1
Stereotypy and Off-task Behaviors Displayed by Subjects in Experiment 1

	Child 1	Child 2	Child 3	Child 4
Stereotypy	waving hand making noises rubbing objects tapping objects snapping fingers	flapping objects tapping objects rocking in chair	crossing eyes flapping hands rocking in chair flapping objects	flapping hands sucking thumb toy in mouth shirt in mouth high-pitch scream
Off-task behavior	out of seat lean chair back	aggression out of seat crying	noncompliance laughing	out of seat lean on therapist lap tap chair feet on chair giggling throw toy bite

in a typical session in the therapy room, or (b) an unstructured free-play session, in which the child remained in the observation room where toys were available. In Experiment 3, no distinction between work and freeplay was made, because there appeared to be no unexpected differences between the work and play environments.

Reliability

Reliability was collected for a minimum of 33% of all baseline and experimental sessions. Interobserver reliability was calculated by dividing the number of agreements by the total number of agreements plus disagreements, then multiplying by 100. Interobserver reliability for side-effect measures of aberrant behavior, stereotypy, and off-task behavior during and after experimental sessions was also collected for a minimum of 33% of each child's total sessions. Interobserver agreement was calculated by dividing the total number of agreements for occurrence and nonoccurrence by the total number of agreements plus disagreements, and then multiplying by 100.

EXPERIMENT 1

METHOD

Subjects

Four male autistic children participated in Experiment 1. Child 1 was a 6.3-year-old boy (mental age was untestable) who frequently engaged in tan-

trums, aggression, and immediate and delayed echolalia. Child 1 also displayed high frequencies of stereotypy (e.g., posturing hand in front of eyes, snapping fingers, making repetitive vocal noises). He rarely spoke spontaneously and only occasionally used three-word sentences (e.g., "I want cookie.").

Child 2 (chronological age, 7.6 years; mental age, 2.9 years) was verbal but often exhibited disruptive behaviors (e.g., noncompliance, crying, aggression) when a difficult task was presented. Additionally, Child 2 frequently engaged in stereotypic behavior (e.g., waving thumb and index fingers in front of eyes, repetitively drawing check marks) and delayed echolalia.

Child 3 (chronological age, 8.5 years; mental age, 4.2 years) was verbal but often noncompliant in learning situations. He also exhibited stereotypic behaviors of crossing eyes and flipping the pages of a telephone book, off-task behavior such as inappropriate bursts of laughter, and frequent ritualistic behavior (e.g., lining up chairs in a specific pattern).

In contrast to the other children, Child 4 (chronological age, 7.0 years; mental age, 3.4 years) had quite limited and poorly articulated speech. This child frequently engaged in noncompliance, tantrums, and aggression (e.g., pinching, biting) during the learning situation. Child 4 also exhibited high frequencies of stereotypy, including sniffing objects and persons and mouthing or biting objects.

Table 2
Stereotypy, Off-task Behaviors, and Delayed Echolalia Displayed by Subjects in Experiment 2

	Child 1	Child 2	Child 3
Stereotypy	crossing eyes flapping hands flapping objects tapping objects	tapping objects	arching hands flapping hands biting hand scratching tapping objects rubbing fingers on legs
Off-task behavior	laughing noncompliance yelling	yelling aggression out of seat laughing noncompliance blowing on therapist face	giggling noncompliance
Delayed echolalia	"Ding! ding! ding! You win again!" "Match Game 83"	"Red red red" "Eat your beef stew!" "It doesn't stop at the eight, it stops at the nine"	"What a mess" "Daddy says get out of here" "Don't be silly" "No laughing" "Cómo está, Señor?"

Tasks

Tasks selected for Child 1 were three discrimination tasks of same/different (i.e., "Give me same" or "Give me different" in sets of three objects), receptive pronouns ("Touch your nose."; "Touch my nose."), and prepositions ("Put in box."; "Put next to box."). For Child 2, tasks were expressive

pronouns ("Whose nose is this?"), what's missing game (recall which of three objects was removed from the set), and immediate recall of previous actions ("Touch head, tummy, and nose—what did you just do?"). Tasks selected for Child 3 were expressive pronouns, what's missing, and discrimination of before and after concepts (experimenter

Table 3
Stereotypy, Off-task Behaviors, and Perseverative Behaviors Displayed by Subjects in Experiment 3

	Child 1	Child 2	Child 3
Stereotypy	tapping hand posturing arm posturing body rocking turning head facial grimace repetitive finger or shoulder movements	tickling self swinging feet masturbating	arching hands hand posturing sticking tongue out swinging feet rubbing legs rubbing pants playing with hair staring at hand or fist
Off-task behavior	out of seat crying laughing lean chair back	noncompliance oppositional arguing complaining squirm in chair whining	out of seat laughing lean chair back
Perseverative behavior	Humpty Dumpty See-N-Say® plastic farm animals (cow, pig, horse, frog, and duck)	leaves trees cactus	Best Products catalog Honda car advertising booklet

Table 4

Interobserver Agreement (%) for Experiments 1, 2, and 3 (O = occurrence; N = nonoccurrence)

Experiment 1	Stereotypy and Off-task					
	O		N			
Child 1	96		99			
Child 2	100		96			
Child 3	92		94			

	Stereotypy		Off-task behavior		Aggression	
	O	N	O	N	O	N
Child 4	98	99	95	98	98	99
Parent 4	93	96	—	—	—	—

Range, 84–100

Experiment 2	Stereotypy and Off-task		Delayed echolalia	
	O	N	O	N
Child 1	91	94	100	100
Child 2	96	98	97	97
Child 3	93	98	100	100
Parent 3	—	—	100	100

Range, 78–100

Experiment 3	Stereotypy		Off-task		Perseverative	
	O	N	O	N	O	N
Child 1	86	88	88	93	95	99
Child 2	95	99	99	100	100	100
Child 3	98	99	98	99	100	99
Parent 1	—	—	—	—	91	98
Parent 2	92	100	—	—	99	100
Parent 3	90	98	—	—	91	96

Range, 75–100

touches three objects, then asks, "What did I touch before/after _____?"). For Child 4, tasks were receptive pronouns, color discriminations ("Give me red block."), and a label/location task (e.g., "What's on the table?").

Procedure

Each child was presented with the three consequence conditions in a multielement fashion. During conditions in which stereotypy was assessed as a consequence, potential reinforcers for the children

were posturing hand in front of eyes for Child 1, tapping a toy three or four times with index finger for Child 2, flipping pages of a telephone book for Child 3, and sniffing fruit-scented drawing markers for Child 4.

Additional analyses for Child 4. To permit a more detailed analysis of possible changes in occurrence of stereotypy as a function of using a specific response as a reinforcer, additional data were collected for Child 4. Aggression (pinching, grabbing, biting, and throwing objects) was recorded separately from off-task behavior, because aggression was a major concern in Child 4's treatment program. Also, the duration of Child 4's postsession observation period was extended from 15 to 30 min, with free-play and work sessions combined, to assess occurrence of stereotypy over a more extended period of time. Finally, to assess the possible side effect of an increase in stereotypy in a non-treatment setting, Child 4's mother recorded the frequency of occurrence of stereotypic behaviors at home both prior to and throughout the study. (This parent previously had been trained in data collection.) Due to Child 4's high frequency of stereotypy, frequency data were collected daily during 5-min observation periods each hour (e.g., after school, in the evenings, and on weekends). Child 4 was chosen for the additional analyses because he was the last participant in this study.

Reliability

In addition to interobserver agreement for correct and incorrect task responses and occurrence and nonoccurrence of inappropriate behaviors for the side-effect data, six reliability checks between Child 4's mother and the experimenter were taken throughout the study. Checks consisted of observing Child 4 during six 5-min unstructured free-play sessions at the after-school program and recording frequency of occurrence of stereotypic behaviors. Interobserver agreement was calculated by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100.

Average interobserver reliability for task performance was 100%, 100%, 98%, and 95% for Chil-

dren 1, 2, 3, and 4, respectively. For occurrence of stereotypy and off-task behavior, mean interobserver reliabilities for occurrence and nonoccurrence are provided in Table 4.

RESULTS AND DISCUSSION

The children's correct task performance is presented in Figure 1; their average baseline performances on these tasks are depicted by the horizontal lines. Baseline probes for Child 1 averaged 50% correct (range, 40%–60%) for a 6-month period, 60% (range, 43%–65%) for Child 2 over a 6-month period, 50% (range, 42%–53%) for Child 3 over an 8-month period, and 60% (range, 45%–65%) for Child 4 over an 8-month period.

For all children, the highest percentage of correct responding was made during sessions in which stereotypy was used as a reinforcer. In addition, the children's performance during sessions of the varied consequences was at least slightly higher than in the food condition. Inspection of the individual data suggests that only stereotypy served as a consistent reinforcer for Child 1. The food condition was associated with a decrease in correct responding compared with baseline, perhaps because food became less salient for Child 1 or because the inaccessibility of stereotypy in the food condition was punishing. This possibility may also explain the decreasing trend for the varied condition. Child 2 also decreased his correct performance compared with baseline in both conditions in which food was available. For Children 3 and 4, both the stereotypy and varied conditions were reinforcing.

Results of experimental session and postsession observations for Children 1, 2, and 3 are shown in Figure 2. Percentages of intervals of occurrence of stereotypy and off-task behavior were combined because the off-task behavior seldom occurred, and were averaged across sessions of each condition. For all 3 children, overall occurrence of stereotypy and off-task behaviors did not increase during sessions in which stereotypy was used as a reinforcer. Indeed, for Children 1 and 2, these inappropriate behaviors occurred less frequently during stereotypy or varied consequence conditions than during food conditions. Similarly, no large increases in stereotypy and

off-task behaviors occurred during postsession observations following sessions of the stereotypy condition. For Child 1 and Child 2, these disruptive behaviors decreased following sessions of this condition compared to the food condition.

Child 4's side-effect data are also presented in Figure 2. The three panels display the results of the experimental session observations and the postsession observations for stereotypy, off-task behavior, and aggression, respectively. As in the other children, no increases in stereotypy or off-task behavior were associated with the use of stereotypy as a reinforcer. Of specific interest is the difference between the mean percentage occurrence of off-task behavior and aggression, which were recorded separately. Both aggressive and off-task behaviors occurred more frequently during postsession observations than during the experimental conditions. It is possible that unobserved factors may have led to an increase in aggression and off-task behaviors. However, it is also likely that using stereotypy as a reinforcer may have been effective in decreasing this child's aggression in addition to increasing task performance. The tasks presented during all the experimental conditions may have become conditioned reinforcers, thus decreasing the occurrence of aggression during the food condition as well.

Results of home observations of Child 4's stereotypy are shown in Figure 3. The mean frequency of occurrence of stereotypy during the 5-min hourly observation periods was averaged across each week. The mean frequency of stereotypy at home decreased after experimental conditions began, suggesting that negative side effects did not occur at home. Child 4's mother reported that she did not implement any procedures that could account for this decrease. However, the home data must be interpreted with caution because the decreasing trend occurred before treatment was implemented.

These results extend previous literature on reinforcer effectiveness by suggesting that (a) the use of stereotypy as a reinforcer may be more effective in improving children's task performance than the use of edible reinforcers, (b) varied reinforcer conditions were not superior to single reinforcer conditions when the reinforcer was stereotypy, and (c)

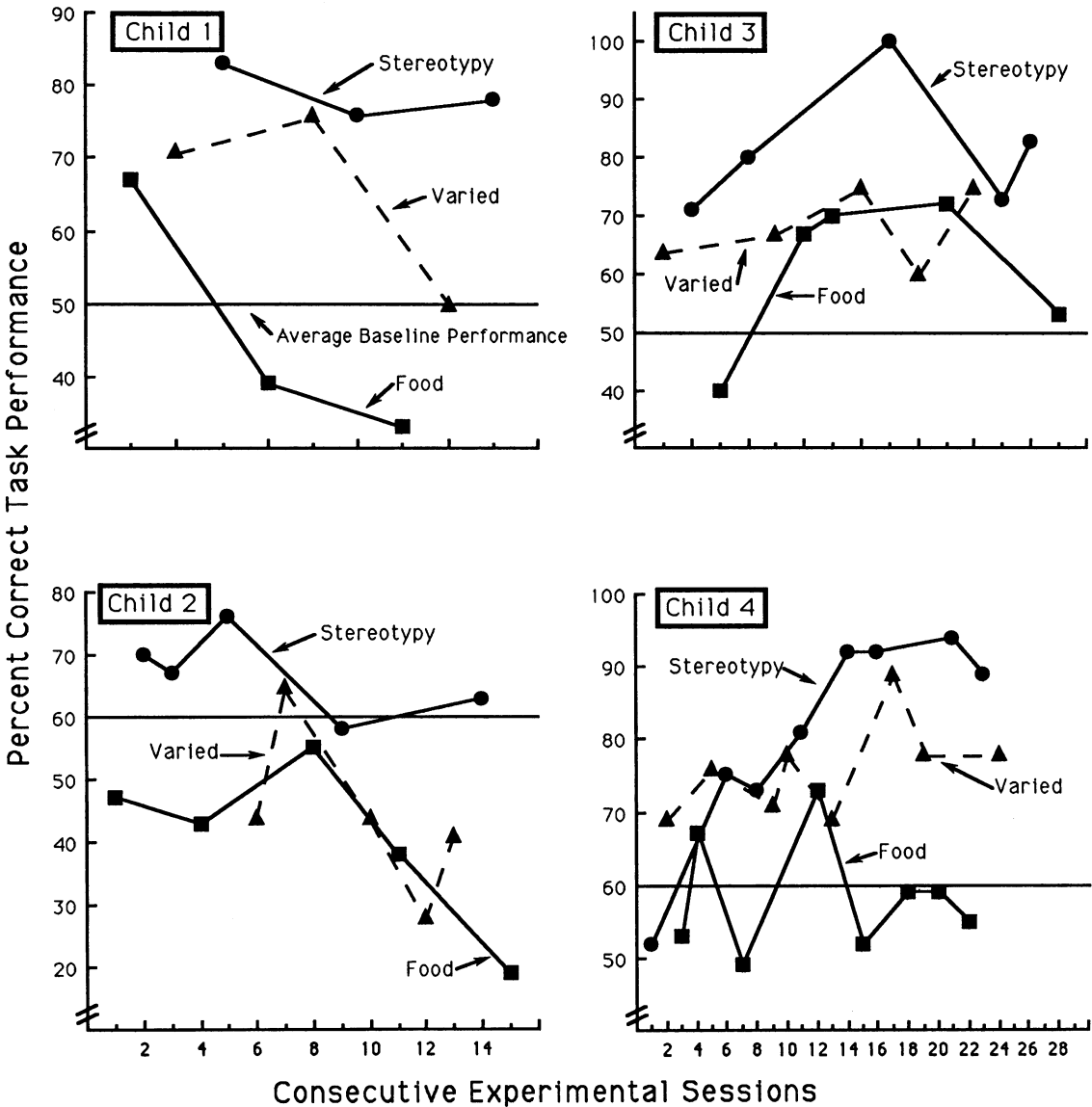


Figure 1. Performance during stereotypy, food, and varied consequence conditions for Children 1, 2, 3, and 4.

the use of stereotypy as a reinforcer was generally not associated with specific negative side effects and may have actually decreased some inappropriate behaviors, as illustrated by Child 4's data.

EXPERIMENT 2

Given the generally positive findings obtained when stereotypy was used as a reinforcer, we decided to study the reinforcing effects of delayed

echolalia. Previous literature suggests that some forms of delayed echolalia may have reinforcing properties (e.g., Lovaas et al., 1977; Prizant & Rydell, 1984); thus, it seemed reasonable to explore the use of this behavior as a reinforcer.

METHOD

Subjects

Three verbal autistic boys participated in this experiment. Child 1 (chronological age, 8.5 years;

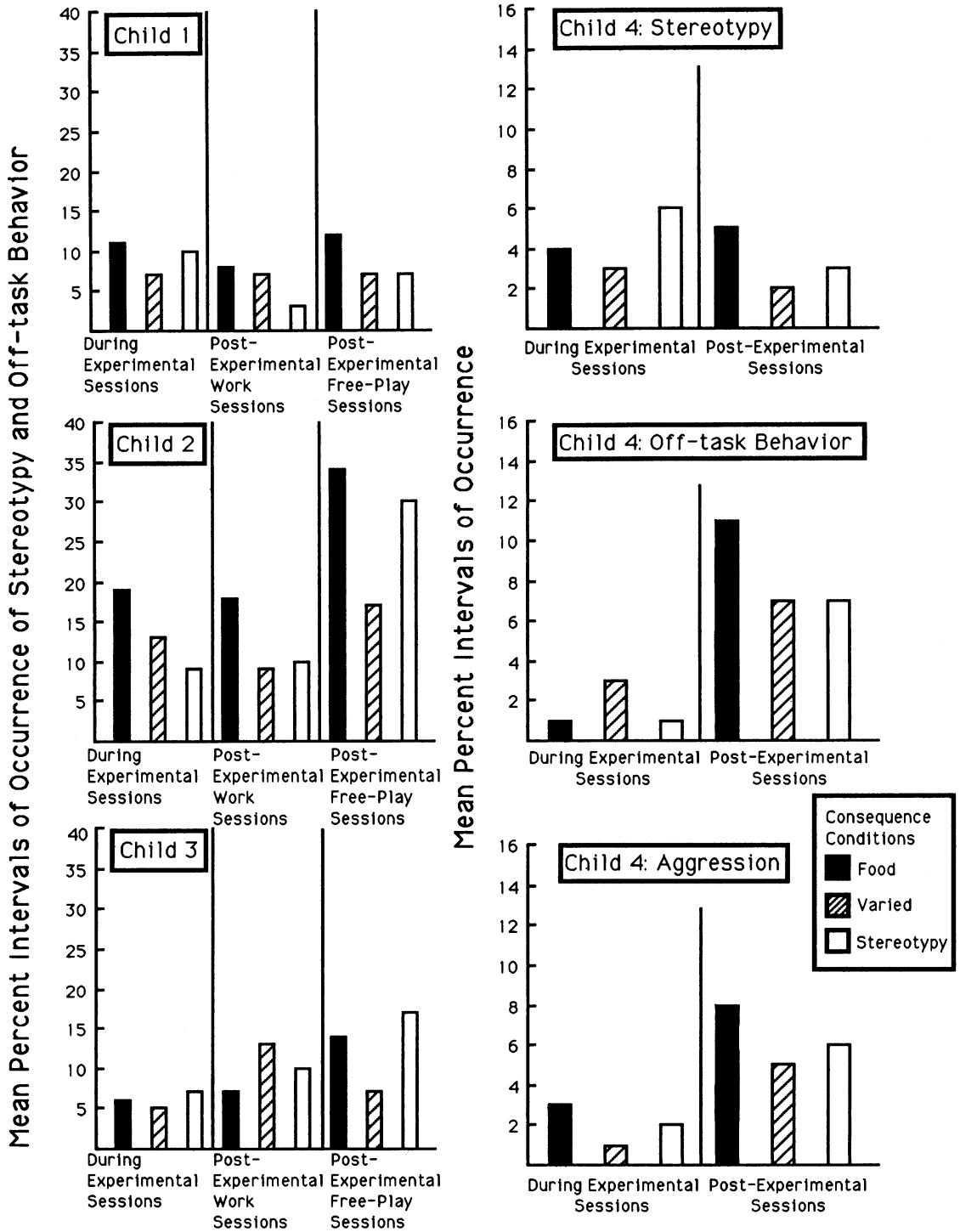


Figure 2. Mean percentage occurrence of stereotypy and off-task behavior during experimental conditions and postexperimental sessions for Children 1, 2, 3, and 4.

IQ, 100) frequently displayed delayed echolalia and typically repeated phrases heard on game shows, such as "I'll go with the X to block." or "Ding! Ding! Ding! You win again!" This child also engaged in frequent stereotypic behaviors (e.g., crossing eyes, lining up toys, finger flapping, and finger rubbing).

Child 2 was an 8.0-year-old boy (IQ, 67) who engaged in a variety of disruptive behaviors during work sessions, including aggression, tantrums, yelling, and noncompliance. He had a relatively large vocabulary and often spoke spontaneously. Delayed echoes frequently uttered by this child included "Red, red, red," "It doesn't stop at the eight, it stops at the nine!," "Go to bed!," and "Eat your beef stew!" Child 2's most frequent forms of stereotypy were pacing, tapping, rocking back and forth, and head rolling.

Child 3 (chronological age, 9.3 years; IQ, 69) engaged in some appropriate spontaneous speech (e.g., requests for specific foods or toys); however, most of his utterances consisted of immediate and delayed echolalia, such as "Get out of there right now!," "Don't poke the dog!," or "Don't be silly, control yourself!" He also engaged in stereotypic behaviors (e.g., hand flapping, rubbing fingers on different textures, spinning objects) as well as off-task behaviors (e.g., noncompliance, inappropriate bursts of laughter).

Tasks

Child 1's tasks consisted of matching a difficult geometric design, adding up coins to a requested amount, and answering cause and effect questions (e.g., "What happens when you drop a ball?"). Tasks for Child 2 were a before/after discrimination task, naming days of the week, and naming items in a specific category (e.g., "Name five fruits."). The tasks for Child 3 were expressive pronouns (e.g., "Who has a watch on?" "You do?"), and possessive pronouns (e.g., "Whose nose is this?" "My nose").

Procedure

A multielement design was used to compare the three potential reinforcer conditions: delayed echoes

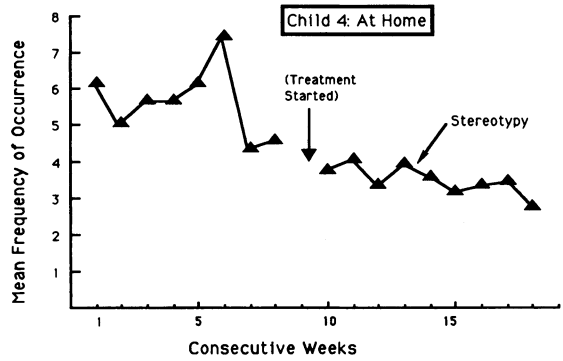


Figure 3. Mean occurrence of stereotypy at home for Child 4.

as a consequence, food as a consequence, and varied (delayed echoes or food) consequences. Experimental sessions were conducted as described earlier, except for Child 3, whose experimental sessions lasted 10 min because he was presented with only two tasks. Dependent measures consisted of the children's task performance; occurrence of stereotypy and off-task behaviors (both during and after experimental sessions) were also recorded. However, during these observations, the occurrence of delayed echolalia (when not used as a reinforcer) was scored separately from the occurrence of stereotypy and off-task behaviors.

During experimental conditions in which delayed echolalia was used as a consequence, the child was permitted to utter a preferred delayed echo after each correct response. The experimenter cued the child after a correct answer by saying, "That's right! What do you want to say?" Initially, because echolalia had previously been discouraged, the experimenter said, "What do you want to say? Do you want to say 'Red, red, red?'" A list of high-frequency delayed echoes to be used as reinforcers was compiled prior to the study by observation and by parental report. Reinforcers in this condition were "Ding! Ding! Ding! You win again," and "Match Game '83" for Child 1; "Eat your beef stew," "Red, red, red," and "It doesn't stop at the eight, it stops at the nine" for Child 2; and "No laughing," "Don't be silly," "Cómo está, Señor?" "Let's eat grilled cheese sandwiches," and "Get out of there right now, do you hear me?" for Child 3.

Additional Analyses for Child 3

Additional data were collected for 1 child to permit a more thorough analysis of possible side effects. Child 3's postsession observation period was extended from 15 to 30 min with work and free-play sessions combined, and Child 3's mother, who had previously been trained in data collection, recorded daily frequency of occurrence of delayed echolalia at home, prior to and throughout the study. Child 3 was chosen for the additional analyses because he was the last child to participate in this experiment.

Reliability

Interobserver reliability was collected and calculated as described earlier. Average reliability for task performance was 99%, 100%, and 99% for Children 1, 2, and 3, respectively. Average reliabilities for occurrence and nonoccurrence of stereotypy, off-task behavior, and delayed echolalia are presented in Table 4. As in Experiment 1, six reliability checks were taken at the after-school program between Child 3's parent and the experimenter. Checks consisted of simultaneously observing Child 3 during a 10-min free play and recording frequency of occurrence of delayed echolalia.

RESULTS AND DISCUSSION

Figure 4 shows the children's task performance across the three reinforcer conditions. The horizontal line denotes the average for baseline performance, which was 60% (range, 50%–62%) for Child 1 during a 7-month period; 55% (range, 50%–58%) for Child 2 over an 8-month period; and for Child 3, 55% (range, 48%–58%) over an 8-month period.

For Children 1 and 3, the delayed echolalia reinforcer conditions were associated with the highest task performance, although there was little difference between the delayed echolalia and varied reinforcer conditions across children. For Child 2, the varied condition was slightly superior to the delayed echolalia condition. Varied reinforcers were more effective in improving performance in this experiment, perhaps because of the larger ratio of

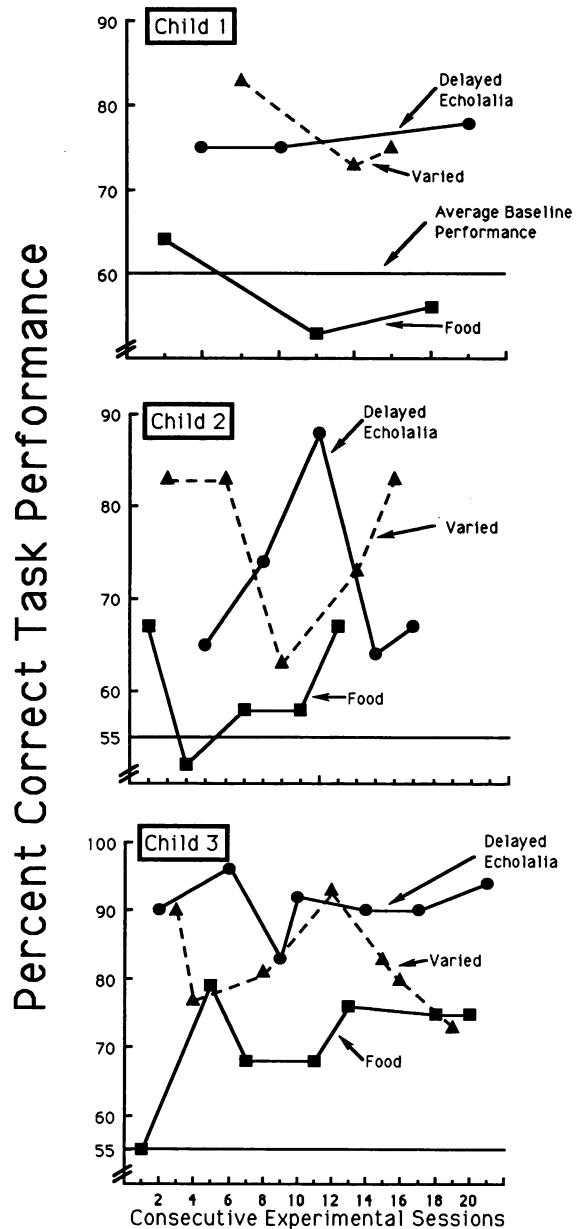


Figure 4. Performance during delayed echolalia, food, and varied consequence conditions for Children 1, 2, and 3.

echoes to food (the children in this experiment actually requested to echo, and at times pushed away the food in preference for an echo). The food condition was reinforcing for Children 2 and 3, but not as effective as the other conditions. For Child 1, performance deteriorated under food consequences compared with baseline.

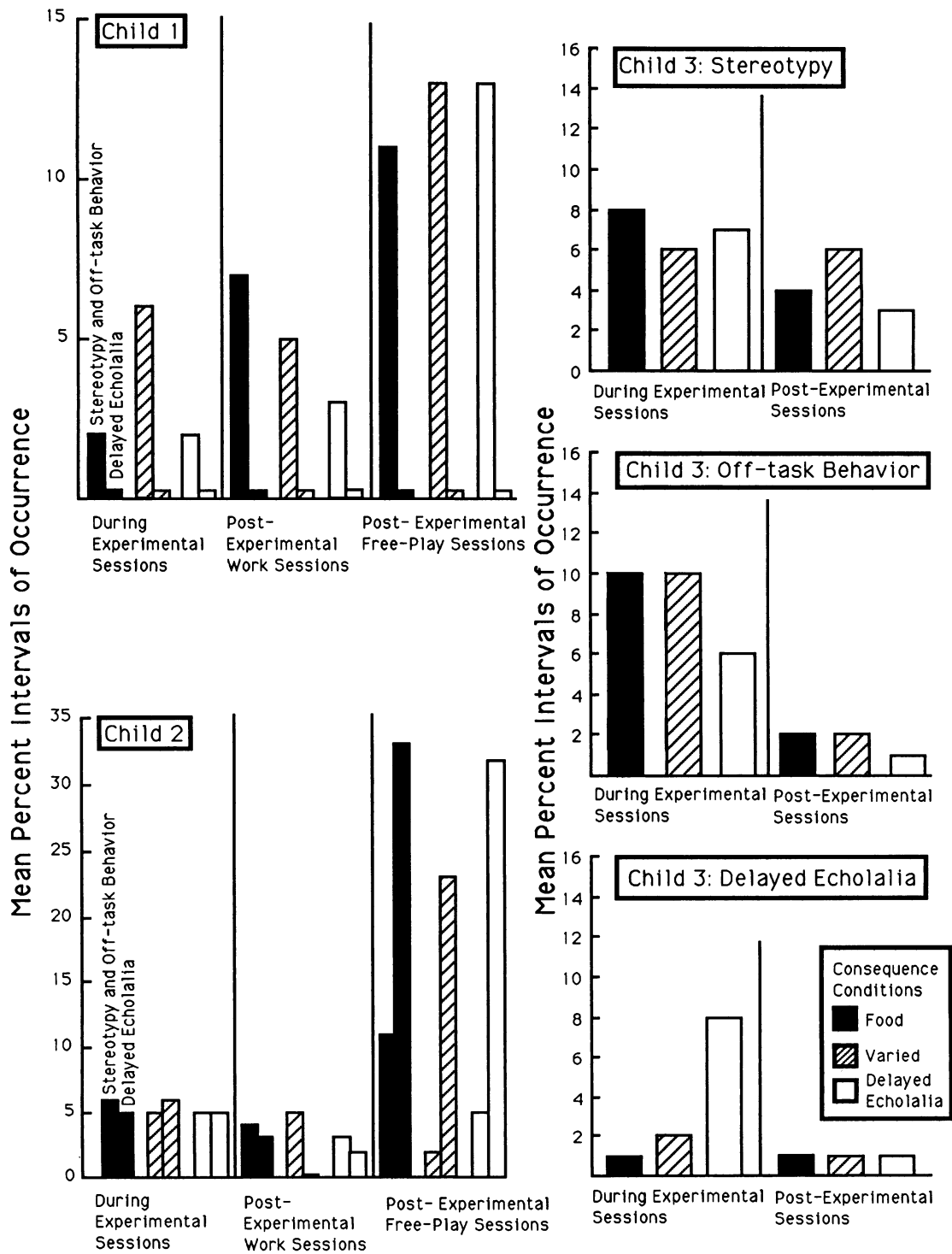


Figure 5. Mean percentage occurrence of stereotypy, off-task behavior, and delayed echolalia during experimental conditions and postexperimental sessions for Children 1, 2, and 3.

Results of experimental session and postsession observations of the occurrence of stereotypy, off-task behavior, and delayed echolalia are provided in Figure 5 for Children 1 and 2. Occurrence of such behaviors during experimental sessions and during postsession observations did not differ much across the three reinforcer conditions, suggesting no negative side effects. Increases were seen, however, in the postexperimental free-play sessions during all conditions for Children 1 and 2. Perhaps, for these children, the lack of structure and supervision in the free-play setting set the occasion for the occurrence of inappropriate behaviors. Such increases did not appear to be a function of any particular experimental condition.

Child 3's side-effect data are also presented in Figure 5. As in Children 1 and 2, results of Child 3's session and postsession observations indicated that little difference in inappropriate behaviors occurred. Home observations of Child 3's occurrence of delayed echolalia are presented in Figure 6; daily frequency of occurrence was averaged across each week. As can be seen, there was a decreasing trend in delayed echolalia at home, and no increases were associated with using an aberrant behavior as a reinforcer. Child 3's mother reported no change in her management of her son's delayed echolalia. However, the home data must be interpreted with caution, because the decreasing trend was observed before treatment began.

The overall results of Experiment 2 suggest that autistic children's delayed echoes may serve as reinforcing events and may be more salient than traditionally used edibles.

EXPERIMENT 3

The results of Experiments 1 and 2 demonstrated the efficacy of using stereotypy and delayed echolalia as reinforcers. In this experiment, a third aberrant behavior, perseverations with specific objects, was studied as a potential reinforcer. Specifically, sessions of perseverative behavior were compared with food and with stereotypy. In addition, side-effect measures were collected for all children, both during and after experimental conditions and at home.

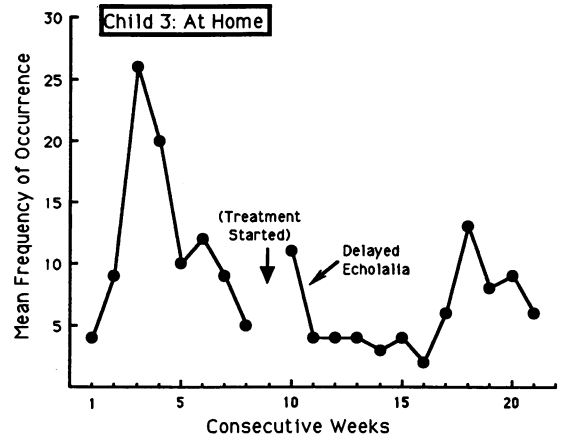


Figure 6. Mean occurrence of delayed echolalia at home for Child 3.

METHOD

Subjects

Three autistic boys participated in Experiment 3. Child 1, a 9.7-year-old boy (mental age, 3.7 years), displayed high frequencies of immediate and delayed echolalia but minimal appropriate speech. During work sessions, Child 1 frequently engaged in off-task behaviors (e.g., crying, laughing, non-compliance) and stereotypy (e.g., tapping objects, body posturing). He also displayed perseverative behavior with five specific plastic toy animals, a See-N-Say® toy, and a Humpty Dumpty doll. In addition to seeking out these specific objects, Child 1 continually talked about these toys as well as about a few specific food items (e.g., "I love those pancakes with syrup.").

Child 2 (chronological age 6.9 years; mental age, 4.5 years) was a verbal boy who spontaneously spoke in full sentences and displayed little echolalia. However, he was frequently noncompliant and oppositional when presented with a difficult task. He also displayed poor eye contact and stereotypy, particularly rubbing the edges of a blanket at home. Child 2 perseverated on trees and leaves, particularly books about pine trees and cactus. His mother reported that, if permitted, he would play outside with branches and leaves for hours at a time. Additionally, he would constantly ask his parents the same questions about different kinds of trees.

Child 3 (chronological age, 6.2 years; mental age, 3.1 years) rarely displayed spontaneous speech,

but did occasionally use short sentences. He also exhibited immediate and delayed echolalia, as well as frequent stereotypy (e.g., twisting hair, repetitively blinking eyes, twirling broken twigs in front of eyes). He also had several perseverative behaviors with objects, including lawn mowers, chain saws, and Honda cars (specifically, 1977 Honda Civics). His mother reported that he would climb trees to watch neighbors tending their lawns, and on several occasions he ran away from home to seek out lawn mowers, chain saws, and Hondas in garages. Child 3 also perseverated on home improvement stores (e.g., Builder's Emporium) and discount stores (e.g., K-Mart, Best Products).

Tasks

As in the previous experiments, three tasks were selected for each child for presentation during experimental sessions. Tasks chosen were prepositions, same/different discriminations, and expressive pronouns for Child 1; telling time by the quarter hour, recall of four previous actions, and recall of days of the week or months of the year for Child 2; and pronouns, recall of three previous actions, and what's missing recall task for Child 3.

Procedure

During baseline, each child was presented with typical 15-min work sessions, during which the three selected tasks were presented as in the food condition. Following baseline, the reinforcer conditions were compared. Perseverative behavior (when not used as a reinforcer) was scored if the child talked about, reached out for, or verbally requested his specific preferred object. Unlike the previous two experiments, a stereotypy condition replaced the varied consequence condition as the third reinforcer condition and was compared against both edibles and perseverative behavior.

Food and stereotypy as consequences. Sessions of food and stereotypy consequence conditions were presented as described previously. Potential reinforcers in the stereotypy condition were, for Child 1, bouncing a small rubber ball on the table for 3 to 5 s; for Child 2, waving fingers in front of eyes or rubbing the edges of a particular corner of his blanket; and for Child 3, twisting strands of hair

in a particular area of his head or twirling a twig (bent in a certain way) in front of his eyes.

Perseverative behavior as a consequence. Sessions of this condition consisted of providing brief access to an object the child perseverated on contingent upon each correct response. After each correct answer, the child was presented with one of these objects for 3 to 5 s. Potential reinforcers available in this condition were, for Child 1, a See-N-Say® toy, five plastic animals (pig, cow, horse, frog, and duck), and a Humpty Dumpty doll; for Child 2, one particular book about trees, one particular book about cactus, and the opportunity to talk about cactus and trees; and for Child 3, a Honda Civic car advertising booklet and a Best Products catalog.

Home observations. Prior to and throughout presentation of experimental conditions, parents (previously trained in data collection) recorded data on the occurrence of stereotypy and perseverative behaviors at home. For Children 2 and 3, frequency data were collected continuously when the child was at home with the parent. Child 1's mother requested that she not be required to collect data on stereotypy because the behavior occurred with great frequency. However, frequency of Child 1's perseverative behavior was recorded by the mother during predetermined 10-min observation periods, three times a day.

Reliability

Reliability for the children's task performance was 93% for Child 1, 98% for Child 2, and 94% for Child 3. Average interobserver agreements for occurrence and nonoccurrence of stereotypy, off-task behavior, and perseverative behavior are presented in Table 4. Three reliability checks were taken throughout the study with each parent; each check consisted of the parent and experimenter observing the child simultaneously during a 10-min free-play session and recording occurrences and nonoccurrences of stereotypy (for Children 2 and 3) and perseverative behavior.

RESULTS AND DISCUSSION

The 3 children's task performances are presented in Figure 7. For all children, the highest percentage

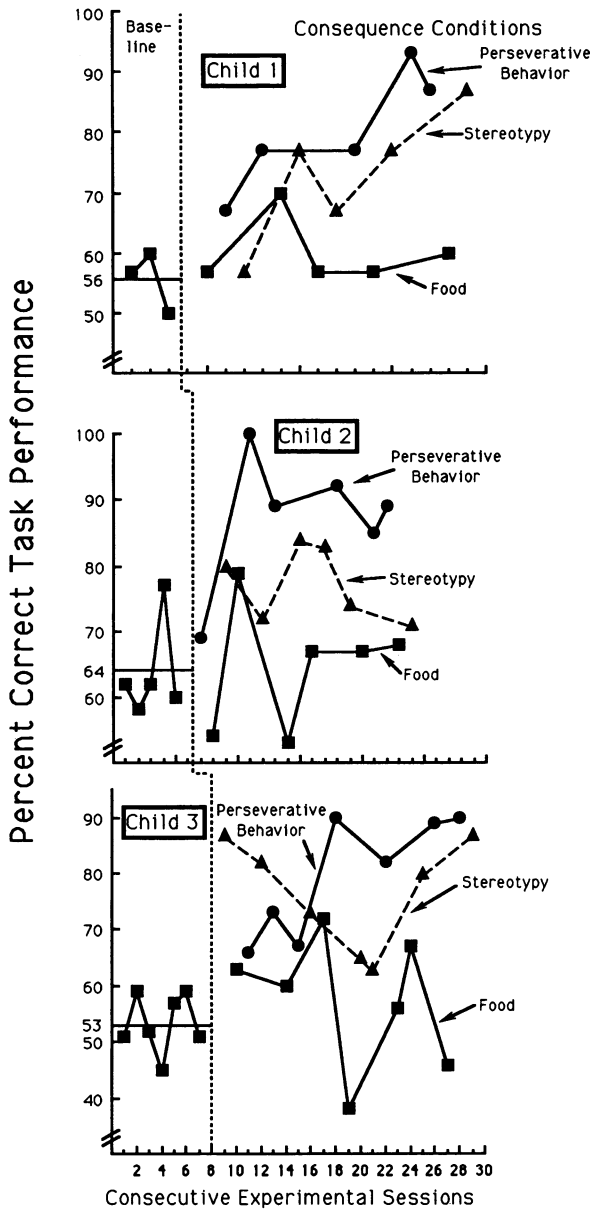


Figure 7. Performance during perseverative behavior, stereotypy, and food consequence conditions for Children 1, 2, and 3.

of correct responding was made during sessions in which perseverative behavior served as reinforcers. The stereotypy condition was only slightly less effective for Children 1 and 3. The food reinforcers were associated with the lowest task performance, being at or below baseline levels for all children.

Mean occurrences of stereotypy, off-task behavior, and perseverative behavior during and after

experimental sessions are shown in Figure 8. Recall that postexperimental sessions consisted of both work and free-play settings combined. For each child, occurrence of each class of behaviors is averaged across the total number of sessions for each condition. As can be seen, stereotypy, off-task, and perseverative behaviors did not increase when perseverative or stereotypic behaviors were used as reinforcers, except for Child 2. These findings are similar to those of Experiments 1 and 2 in suggesting that no negative side effects occurred.

Results of home observations are shown in Figure 9. Note that for Children 2 and 3, baseline recording of perseverative behavior was begun several weeks prior to baseline recording of stereotypy, resulting in fewer baseline data points for stereotypy. For Children 1 and 2, perseverative behavior initially increased when experimental conditions were introduced. However, a decreasing trend occurred after the initial increase. This was also evident with stereotypy for Child 2. For Child 3, frequency of perseverative behavior remained low after implementation of the experimental conditions; however, this result is difficult to interpret because of the decreasing trend during baseline. Similar results occurred for Child 3's stereotypic behavior. The parents of all 3 children reported that they made no changes in their management of the aberrant behaviors during the course of the study.

These findings suggest that both stereotypic and perseverative behaviors were more effective than edibles in improving the children's task performance, with perseverative behavior slightly more effective than stereotypy. Negative side effects were not observed at the after-school program or at home.

GENERAL DISCUSSION

In three experiments, autistic children's aberrant behaviors were successfully used as reinforcers to improve their performance on difficult tasks, and overall increases in aberrant behavior did not occur as an undesirable side effect. Comparable results from home observations of inappropriate behaviors provided additional support for the efficacy of using aberrant behaviors as reinforcers. Differences in the children's task performance across the experimental

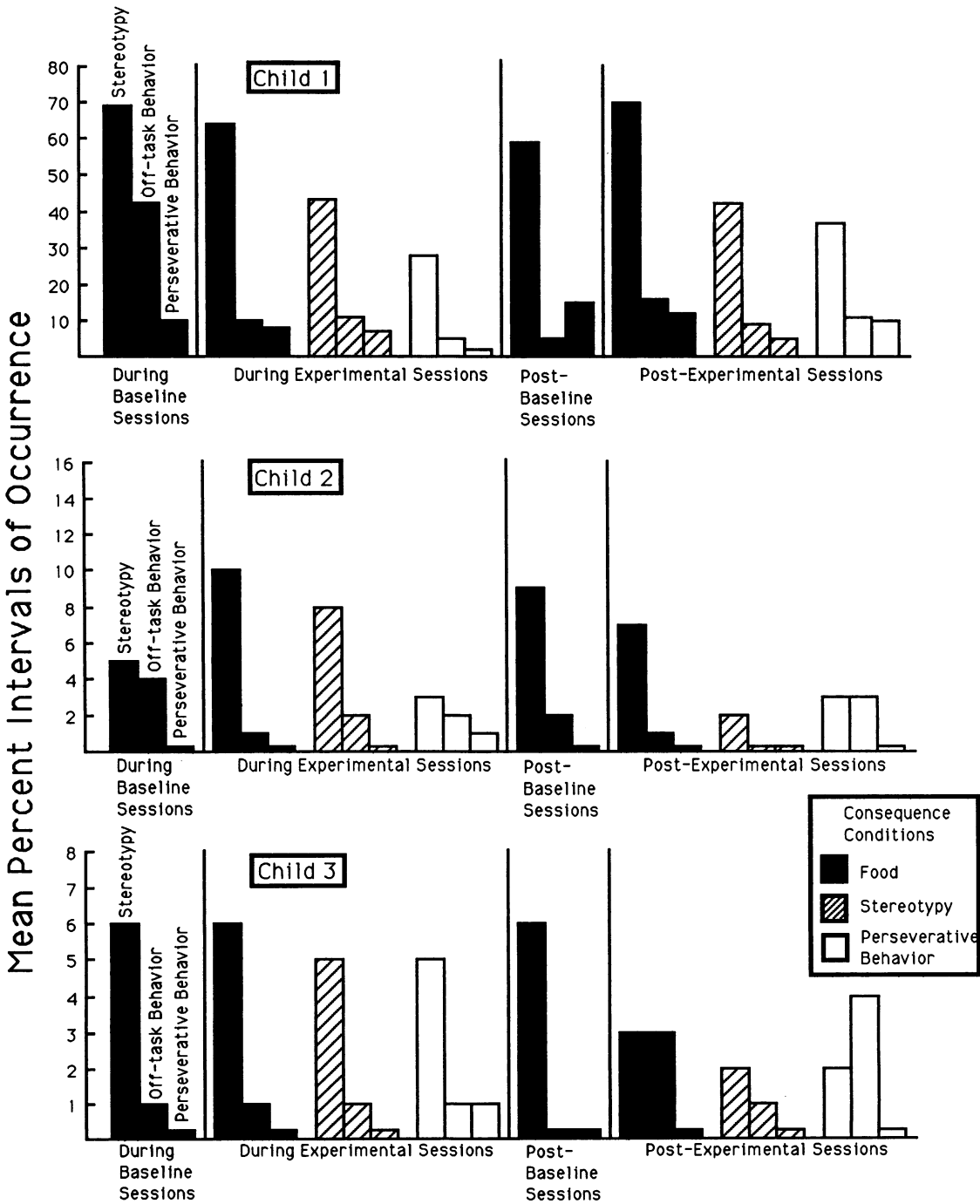


Figure 8. Mean percentage occurrence of stereotypy, off-task, and perseverative behavior during experimental conditions and postexperimental sessions for Children 1, 2, and 3.

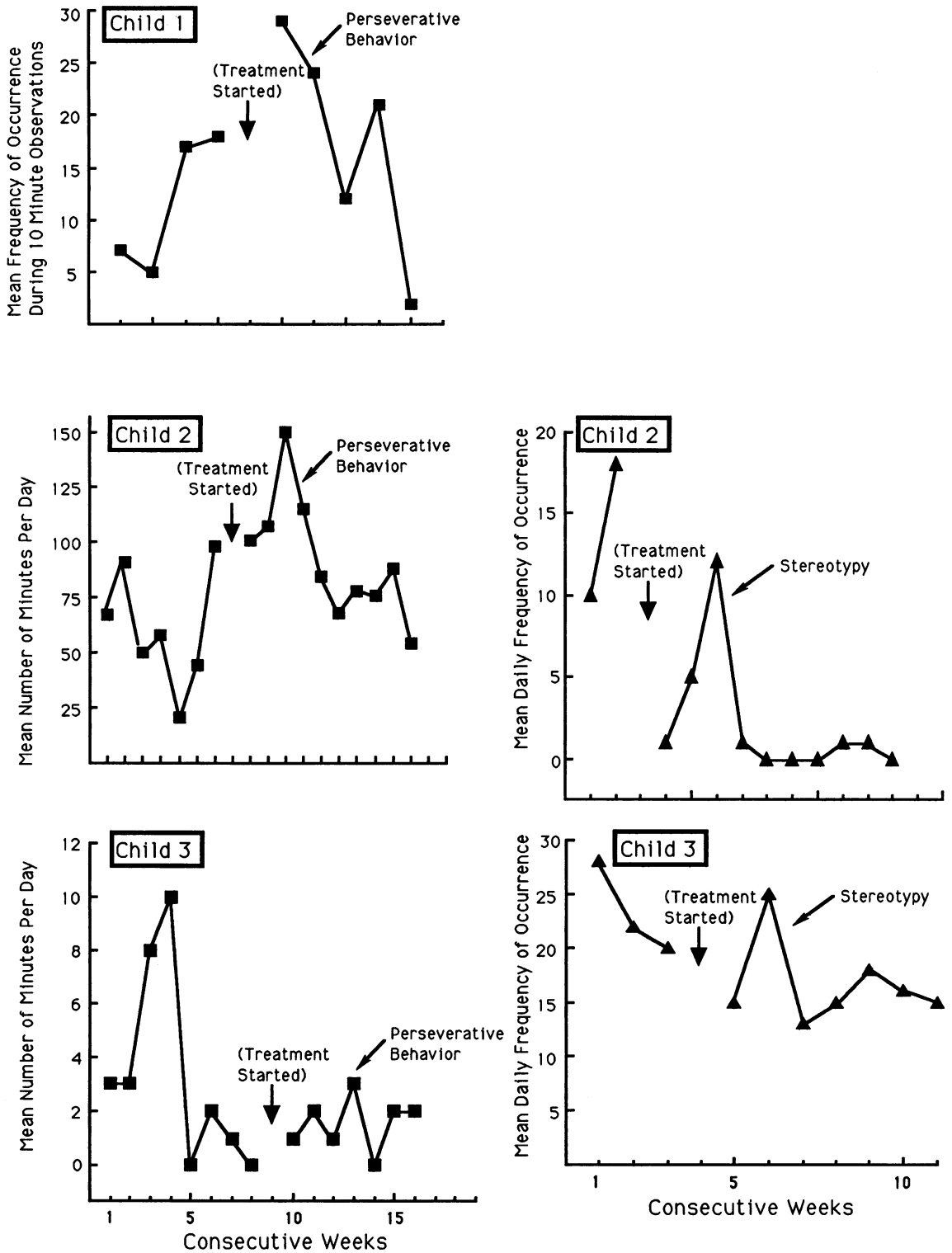


Figure 9. Mean occurrence of stereotypy and perseverative behavior at home for Children 1, 2, and 3.

conditions may be best explained in terms of the saliency of the aberrant behaviors used as reinforcers (Rincover, Newsom, Lovaas, & Koegel, 1977; Wolery *et al.*, 1985). It has been demonstrated that stereotypy can be reinforcing, perhaps because it contains specific sensory or perceptual properties (Rincover & Newsom, 1985), and it has been hypothesized that the perceptual reinforcers provided by stereotypy are primary reinforcers because they serve an organic function of stimulation in the central nervous system (Lovaas *et al.*, 1987). Thus, it is not surprising that stereotypy was a potent reinforcer for autistic children. Importantly, the superior task performance displayed by all children during delayed echolalia and perseverative behavior conditions suggests that these behaviors also provide highly salient reinforcing properties for these children.

Previous studies on sensory reinforcement and sensory extinction (e.g., Rincover, 1978; Rincover, Cook, Peoples, & Packard, 1979) have identified the reinforcing auditory, visual, or proprioceptive sensory consequences that maintain stereotypic behavior in autistic children. It is possible that such sensory consequences may also maintain echolalic and perseverative behavior. Lovaas and his colleagues (Epstein *et al.*, 1985; Lovaas *et al.*, 1987) proposed that some forms of delayed echolalia and perseverative behavior may be more complex (i.e., higher level) forms of stereotypic behavior, due to the repetitive nature of these behaviors, the complex perceptual stimuli produced by them, and their interference with acquisition of appropriate behaviors. Empirical support for this supposition has been provided by the results of long-term intensive treatment of autistic children, which show that as the children learn speech and academic tasks, low-level stereotypy (e.g., body rocking) is decreased and progression to intermediate levels of stereotypy (e.g., echolalic speech) and ultimately higher levels (e.g., perseveration on numbers) may occur (Epstein *et al.*, 1985). It is possible that perseverative behavior and delayed echoes are more sophisticated forms of stereotypy and thus may be more salient reinforcers for some children than stereotypy.

The absence of observed negative side effects

during and after work sessions for all experiments, as well as at home, provides important additional support for the use of aberrant behaviors as reinforcers. The children engaged in the aberrant behaviors as reinforcers in a controlled manner. They did not engage in excessive stereotypic responses or resist when a preferred object was taken away after the 5 s of access. The children often returned the object unasked and waited patiently for the next trial. For example, after a correct response in Experiment 3, Child 1 held and gazed at the plastic toy cow, said, "I love that cow!" and immediately returned it to the therapist. Similarly, Child 4 (Experiment 1) selected a scented magic marker from the table after a correct answer, handed it to the experimenter to be opened so he could sniff it, and then took it back and placed it on the table without a request from the experimenter. These anecdotal observations of the children's eagerness to work and their displays of control when allowed to engage in the aberrant behaviors are quite encouraging.

The difficulty in eliminating autistic children's aberrant behaviors has been well demonstrated (e.g., Favell, McGimsey, & Jones, 1978; Foxx & Azrin, 1973; Marchant, Howlin, Yule, & Rutter, 1974; Rincover & Koegel, 1977; Schreibman & Carr, 1978). Rather than persisting in these efforts, a more pragmatic approach may be to identify functional aspects (i.e., reinforcing properties) of these behaviors and use them to advantage (i.e., as reinforcers) to teach new, adaptive responses. The identification and success of such salient and easy-to-use reinforcers provide teachers and therapists with an important and much-needed alternative approach to standard educational and behavior change programs.

Not all autistic children are ideal candidates for these procedures. For example, some children may not display perseverative behavior, or the objects may not be available (e.g., a traffic light). Some highly preferred forms of stereotypy, such as saliva swishing or eye gazing, may not be easily controlled by the therapist. Finally, the present study did not address the long-term use of these reinforcers, although our anecdotal observations are consistent with the experimental findings. In spite of these

potential limitations, the procedures appear to be quite effective and pragmatic. Given the pervasive lack of motivation reported for many autistic children, the results of this study provide hope for shaping a more promising future for these special children.

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